CLAIMS

We claim:

1. A chiral, non-racemic liquid crystal composition which comprises an achiral liquid crystal host and up to about 100% by weight of one or more chiral, non-racemic compounds having the formula:

wherein n and m are integers ranging from 1 to about 20;

a, b, p and q are either 0 or 1, when p is 0, a is 0 and when q is 0, b is 0;

Y is a single bond or an oxygen;

X is selected from the group consisting of a single bond, oxygen, -CO-, -O-CO-, and -CO-O-;

CR is a chiral, non-racemic tail group except that CR cannot be a chiral hydrocarbon tail;

A and B, independently, are linker groups that can be selected from the group consisting of -CO-, -O-CO-, -CO-O-, -CH₂-CH₂-, -CH₂-CH₂-O-, -O-CH₂-CH₂-, -C \equiv C-, and -C=C-C=C-;

W¹, W², and W³, independently, represent one or more optional substituents on core rings which can be selected from the group consisting of H, halide, alkyl, haloalkyl, alkenyl, haloalkenyl, nitro and nitrile; and

rings T, A and B together representing the mesogenic core are selected from the group cyclohexane, cyclohexene, a phenyl and a naphthyl group wherein one or two ring CH₂ groups or CH groups are replaced by -N-, NH, -O- or -CO-.

2. The composition of claim 1 wherein CR is selected from the group consisting of:

$$\begin{array}{c}
R^{1} \\
R^{2}
\end{array}$$

$$\begin{array}{c}
C \\
R^{3}
\end{array}$$

$$\begin{array}{c}
R^{1} \\
R^{2}
\end{array}$$

$$\begin{array}{c}
R^{1} \\
R^{2}
\end{array}$$

$$\begin{array}{c}
R^{1} \\
R^{2}
\end{array}$$

$$\begin{array}{c}
R^{2} \\
R^{3}
\end{array}$$

wherein * indicates an asymmetric carbon; R^1 and R^3 , independently of each other, are lower alkyl or alkenyl groups optionally substituted with one or more halogens, and R^2 is an alkyl, alkenyl, ether, thioether, or silyl group having from 1 to about 20 carbon atoms wherein one or more CH_2 groups are replaced with -S-, -O-, -CO-, -CO-O-, or -Si(R')₂, and where R' is a lower alkyl optionally substituted with one or more halogens.

3. The composition of claim 1 wherein CR is:

$$R^1$$
 O R^2 R^3

4. The composition of claim 1 wherein CR is:

5. The composition of claim 1 wherein CR is:

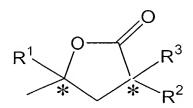
6. The composition of claim 1 wherein CR is:

$$R^1$$
 R^2
 R^2

7. The composition of claim 1 wherein CR is:

$$R^1$$
 R^2
 R^3

8. The composition of claim 1 wherein CR is:



9. The composition of claim 1 wherein CR is:

- 10. The composition of claim 1 wherein the chiral nonracemic compound has a biphenyl mesogenic core.
- 11. The composition of claim 1 wherein the chiral nonracemic compound has the mesogenic core:

12. The composition of claim 1 wherein the chiral nonracemic compound has the mesogenic core:

$$- \left\langle \begin{array}{c} N \\ N \end{array} \right\rangle$$

13. The composition of claim 1 wherein the chiral nonracemic compound has the mesogenic core:

where R" is a lower alkyl group.

- 15. The composition of claim 1 wherein the host is MX6111.
- 16. The composition of claim 1 wherein the chiral nonracemic compound has the formula:

$$C_n F_{2n+1} C_m H_{2m} - C_n F_{2n+1} C_m$$

17. The composition of claim 1 wherein the chiral nonracemic compound has the formula:

$$C_nF_{2n+1}C_mH_{2m}$$
 $C_nF_{2n+1}C_mH_{2m}$
 $C_nF_{2n+1}C_mH_{2m}$
 $C_nF_{2n+1}C_mH_{2m}$
 $C_nF_{2n+1}C_mH_{2m}$

18. The composition of claim 1 wherein the chiral nonracemic compound has the formula:

$$C_n F_{2n+1} C_m H_{2m} - O$$

$$T$$

$$A$$

$$C_n F_{2n+1} C_m H_{2m} - O$$

$$R^2$$

- 19. The composition of claim 18 wherein in the chiral nonracemic compound both of rings T and A are phenyl rings in which one or two of the CH groups can be replaced with a N and wherein W¹ is selected from the group of halogens, alkyl groups or haloalkyl groups.
- 20. The composition of claim 1 wherein in the chiral nonracemic compound n = m.
- 21. The composition of claim 1 wherein in the chiral nonracemic compound Y is O.
- 22. The composition of claim 1 wherein the chiral nonracemic compounds are present in the composition at a level of 10% or less.

- 23. The composition of claim 1 which has Ps of 10 nC/cm² or more at room temperature.
- 24. The composition of claim 23 wherein the chiral nonracemic compounds are present at a level of 5% by weight or less.
- 25. A chiral nonracemic compound having the formula:

$$C_n F_{2n+1} C_m H_{2m} - O$$

$$\begin{array}{c} R^1 \\ A \\ W^2 \end{array}$$

where n and m are integers ranging from 1 to about 15, W¹ and W², independently, represent one or more optional substituents on mesogenic core rings which can be selected from the group consisting of H, halide, alkyl, haloalkyl, alkenyl, haloalkenyl, and nitrile; rings T and A together representing the mesogenic core are selected from the group cyclohexane, cyclohexene, a phenyl and a naphthyl group wherein one or two ring CH₂ groups or CH groups are replaced by -N-, NH, -O- or -CO-; R¹ is a lower alkyl or alkenyl group optionally substituted with one or more halogens and R² is an alkyl, alkenyl, ether, thioether, or silyl group having from 1 to about 20 carbon atoms wherein one or more CH₂ groups are replaced with -S-, -O-, -CO-, -CO-O-, -O-CO-, or -Si(R¹)₂, and where R¹ is a lower alkyl optionally substituted with one or more halogens.

- 26. The compound of claim 25 wherein n = m.
- 27. The compound of claim 25 wherein R^1 is a methyl group.
- 28. The compound of claim 25 wherein the mesogenic core is:

29. The compound of claim 25 wherein the mesogenic core is biphenyl.

30. A chiral nonracemic compound having the formula:

$$C_nF_{2n+1}C_mH_{2m}-O$$
 T
 A
 $C_nF_{2n+1}C_mH_{2m}-O$
 R^3

where n and m are integers ranging from 1 to about 15, W¹ and W², independently, represent one or more optional substituents on mesogenic core rings which can be selected from the group consisting of H, halide, alkyl, haloalkyl, alkenyl, haloalkenyl, and nitrile; rings T and A together representing the mesogenic core are selected from the group cyclohexane, cyclohexene, a phenyl and a naphthyl group wherein one or two ring CH₂ groups or CH groups are replaced by -N-, NH, -O- or -CO-; R¹ and R³ are lower alkyl or alkenyl groups that are optionally substituted with one or more halogens and R² is an alkyl, alkenyl, ether, thioether, or silyl group having from 1 to about 20 carbon atoms wherein one or more CH₂ groups are replaced with -S-, -O-, -CO-O-, -O-CO-, or -Si(R²)₂, and where R² is a lower alkyl optionally substituted with one or more halogens.

- 31. The compound of claim 30 wherein n = m.
- 32. The compound of claim 30 wherein R¹ and R³ are both methyl groups.
- 33. The chiral nonracemic compound of claim 30 wherein the mesogenic core is biphenyl.
- 34. The chiral nonracemic compound of claim 33 wherein the mesogenic core is:

$$N$$
 N N

35. A chiral nonracemic compound having the formula:

$$C_nF_{2n+1}C_mH_{2m}-O$$

where n and m are integers ranging from 1 to about 15 and R^2 is an alkyl, alkenyl, ether, thioether, or silyl group having from 1 to about 20 carbon atoms wherein one or more CH_2 groups are replaced with -S-, -O-, -CO-, -CO-O-, or -Si(R')₂, and where R' is a lower alkyl optionally substituted with one or more halogens.

- 37. The compound of claim 36 wherein n = m.
- 38. A chiral nonracemic compound having the formula:

$$C_nF_{2n+1}C_mH_{2m}-O$$

where n and m are integers ranging from 1 to about 15 and R² is an alkyl, alkenyl, ether, thioether, or silyl group having from 1 to about 20 carbon atoms wherein one or more CH₂ groups are replaced with -S-, -O-, -CO-, -CO-O-, -O-CO-, or -Si(R')₂, and where R' is a lower alkyl optionally substituted with one or more halogens.

- 39. The compound of claim 38 wherein n = m.
- 40. An optical device comprising one or more compounds of claim 1.